

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: PATRICK et al.

Attorney Docket No.:

LAM1P061/P0318

Application No.: 08/925,985

Examiner: MARKOFF, A.

Filed: September 9, 1997

Group: 1746

Title: APPARATUS FOR IMPROVING ETCH  
UNIFORMITY AND METHODS THEREFOR

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(37 CFR 192)

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This brief is in furtherance of the Notice of Appeal filed in this case on June 7, 2001.  
This brief is transmitted in triplicate.

This application is on behalf of

☐

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☒

Large Entity

Pursuant to 37 CFR 1.17(f), the fee for filing the Appeal Brief is:

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Applicant(s) hereby petition for a \_\_\_\_\_ extension(s) of time to under 37 CFR 1.136.

If an additional extension of time is required, please consider this a petition therefor

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\$ An extension for \_\_\_\_\_ months has already been secured and the fee paid therefor of \_\_\_\_\_ is deducted from the total fee due for the total months of extension now requested.

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☒ Applicant(s) believe that no (additional) Extension of Time is required; however, if it is determined that such an extension is required, Applicant(s) hereby petition that such an extension be granted and authorize the Commissioner to charge the required fees for an Extension of Time under 37 CFR 1.136 to Deposit Account No. 50-0388 (Order No. LAM1P061).

Total Fee Due:

Appeal Brief fee	\$310.00
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☒ Enclosed is Check No. 1878 in the amount of \$310.00.

☒ Charge any additional fees or credit any overpayment to Deposit Account No. 50-0388, (Order No. LAM1P061). Two copies of this transmittal are enclosed.

Respectfully submitted,  
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**PATENT**  
**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

**EX PARTE PATRICK et al.**

**Application for Patent**

**Filed: September 9, 1997**

**Serial No. 08/925,985**


**FOR:**

**APPARATUS FOR IMPROVING ETCH UNIFORMITY AND METHODS THEREFOR**

**APPEAL BRIEF**

**CERTIFICATE OF MAILING**

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Signed:   
Sue Funchess  
Secretary to Michael Lee, Reg. No. 31,846

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**(1) REAL PARTY IN INTEREST**

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**(2) RELATED APPEALS AND INTERFERENCES**

N/A

**(3) STATUS OF CLAIMS**

Claims 1, 2, 4-10, and 25-33 are pending in this application. Claims 1-24 were submitted with the application as filed. Claims 11-24 were cancelled in response to a restriction requirement in the first Office Action. Claim 1 was amended and claims 25-33 were added in the response to the first Office Action. A Continued Prosecution Application (CPA) was filed on May 12, 2000, with a preliminary amendment and a 37 CFR 1.132 declaration. The preliminary amendment amended claims 1, 4, 26, and 33, cleared up a numbering discrepancy for claims 25-33, and cancelled claims 3, 11-24, and 34-35. In an office action to the CPA dated March 23, 2001, claims 1, 2, 4-10, and 25-33 were rejected under 35 U.S.C. §112 as being indefinite. Claims 1, 2, 7, 25, and 31 were rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent 5,685,914 to Hills et al. (hereinafter referred to as Hills). Claims 1, 2, 4-10, 25, 26, 27, 28-31, and 33 were rejected under 35 U.S.C. §102 as being anticipated by Ye et al. (hereinafter referred to as Ye). Claim 33 was rejected under 35 U.S.C. §103 as being made obvious by Hills. Claims 4-6, 8-10, 26-30, and 32 were rejected under 35 U.S.C. §103 as being made obvious by Hills in view of Abraham and Abraham et al. Claim 32 was rejected under 35 U.S.C. §103 as being unpatentable over Ye et al. Claims 1, 2, 7, 25, 31, and 33 were rejected under 35 U.S.C. §103 as being unpatentable over Hills et al. in view of any of Shamouilian et al., Kao et al., Zhao et al., Bhan et al., Rossman et al., and Ye et al. Claims 4-6, 8-10, 26-30, and 32 were rejected under 35 U.S.C. §103 as being unpatentable over Hills et al. in view of any of Shamouilian et al., Kao et al., Zhao et al., Bhan et al., Rossman et al., and Ye et al. and further in view of Abraham and Abraham et al. An amendment filed on July 11, 2001 is amending claim 30 to correct a typographical error and make claim 30 properly dependent on claim 25.

All rejections of claims 1, 2, 4-10, and 25-33 are appealed.

#### **(4) STATUS OF AMENDMENTS**

An amendment was filed on July 11, 2001 to correct a typographical error in claim 30 and to make claim 30 properly dependent on claim 25.

#### **(5) SUMMARY OF INVENTION**

All the claims on appeal are directed at semiconductor-based device processing. More specifically, claims 1, 2, 4-10, and 25-33 recite a method of improving etch uniformity in a plasma processing chamber 520 (FIG. 5). A semiconductor substrate 102 (FIG. 5) is placed in an annular sacrificial substrate holder 402 with a substantially pure metal upper surface, which is flushed with an upper surface of the semiconductor substrate (page 10, lines 9-10), which is placed in the plasma processing chamber. A plasma is created so that the plasma etches the upper surface of the substrate and the substantially pure metal upper surface of the sacrificial substrate holder to thereby improve etch uniformity (page 11, lines 27-30).

#### **(6) ISSUES**

The issues, which Appellant believes to be most pertinent to the present appeal, include:

- A) Whether claims 1, 2, 4-10 are indefinite under 35 U.S.C. §112 for the use of the phrase “pure metallic material”.
- B) Whether claim 4 is indefinite under 35 U.S.C. §112 when reciting that the pure metallic material is pure aluminum.
- C) Whether claims 9 and 30 are indefinite under 35 U.S.C. §112 when reciting that the pure metallic material is 99.999% pure aluminum.
- D) Whether claims 25-33 are indefinite under 35 U.S.C. §112 for the use of the phrase “substantially pure metallic planar upper surface”.
- E) Whether claim 26 is indefinite under 35 U.S.C. §112 when reciting that the substantially pure metallic planar upper surface consists essentially of aluminum.
- F) Whether claims 1, 2, 7, 25, and 31 are anticipated under 35 U.S.C. §102 by Hills.

G) Whether claims 1, 2, 4-10, 25, 26, 27, 28-31 are anticipated under 35 U.S.C. §102 by Ye.

H) Whether claim 33 is made unpatentable under 35 U.S.C. §103 over Hills.

I) Whether claims 4-6, 8-10, 26-30, and 32 are made unpatentable under 35 U.S.C. §103 over Hills in view of Abraham and Abraham et al.

J) Whether claim 32 is made unpatentable under 35 U.S.C. §103 over Ye.

K) Whether claims 1, 2, 7, 25, 31, and 33 are made unpatentable under 35 U.S.C. §103 over Hills in view of any of Shamouilian et al, Kao et al., Zhao et al., Bhan et al., Rossman et al., and Ye.

L) Whether claims 4-6, 8-10, 26-30, and 32 are made unpatentable under 35 U.S.C. §103 over Hills in view of any of Shamouilian et al, Kao et al., Zhao et al., Bhan et al., Rossman et al., Ye, an in further view of Abraham and Abraham et al.

#### **(7) GROUPING OF THE CLAIMS**

The rejected claims do not stand or fall together, and will be argued separately. The following claim groups will be argued separately.

I. 1, 2, 7, 8, 10

II. 4, 5, 6

III. 9

IV. 25, 29, 31, 32, 33

V. 26, 27, 28

VI. 30

#### **(8) ARGUMENTS**

##### **35 U.S.C. §112 Rejection**

Claims 1, 2, 4-10, and 25-33 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner stated that the claims are indefinite because the terms “pure

metallic material” and “substantially pure metallic material” are relative terms lacking proper comparative basis.

**Group I Argument**

The applicants contend that the phrase “pure metallic material” used in claim 1 is not indefinite. The Examiner stated that this is a relative term lacking proper comparative basis. The applicants contend that one of ordinary skill in the art would understand the scope of what is claimed, when the term “pure metallic material” is used.

**Group II Argument**

The applicants contend that the recitation that the pure metallic material comprises pure aluminum, as recited in claim 4, causes the recitation of pure metallic material to not be indefinite.

**Group III Argument**

The applicants contend that the recitation that the pure metallic material comprises 99.999% pure aluminum, as recited in claim 9, causes the recitation of pure metallic material to not be indefinite.

**Group IV Argument**

The applicants contend that the phrase “substantially pure metallic planar upper surface” is not indefinite. The Examiner stated that this is a relative term lacking proper comparative basis. The applicants contend that one of ordinary skill in the art would understand the scope of what is claimed, when the term “substantially pure metallic material” is used as required by *Andrew Corp. v. Gabriel Electronics*, 847 F.2d 819, 6 USPQ2d 2010 (Fed. Cir. 1988).

**Group V Argument**

The applicants contend that the recitation that the substantially pure metallic planar upper surface consists essentially of aluminum, as recited in claim 26, causes the recitation of substantially pure metallic planar upper surface to not be indefinite.

**Group VI Argument**

The applicants contend that the recitation that the substantially pure metallic planar upper surface comprises 99.999% aluminum, as recited in claim 30, causes the recitation of substantially pure metallic planar upper surface to not be indefinite.

**35 U.S.C. §102 Rejection of Claims 1, 2, 7, 25, and 31 under Hills**

The Examiner stated that Hills et al. teach improving the etch uniformity of a plasma process by the use of a ring (124) where the ring has a surface, which is even and parallel with



the surface of the substrate (110), and the ring surrounds the substrate and is made of aluminum (column 5, lines 60-66) of Hills.

### **Group I Argument**

Hills et al. does not disclose the simultaneous etching of the ring (124) and the substrate, as recited in claim 1. The Examiner failed to point out anything in Hills et al. that discloses that the ring (124) is etched. In addition, the Examiner cited col. 5, lines 60-66, of Hills et al. as stating that ring (124) is anodized aluminum. The cited passage states that the "pedestal focus ring" (114), the "gas distribution plate" (170), the "gas distribution ring" (172), and their component parts are made of anodized aluminum. Anodized aluminum has an aluminum oxygen combination surface, and therefore is not pure metal as recited in claim 1. The declaration by Roger Patrick, submitted with the March 2, 2001 preliminary amendment states that anodized aluminum is difficult to etch and therefore would be less likely to form a sacrificial upper surface. In addition, ring 124 is not the "pedestal focus ring" (114), the "gas distribution plate" (170), the "gas distribution ring" (172), or one of their component parts. Instead ring 124 is a supporting annulus. For these reasons, claim 1 is not anticipated by Hills et al.

Claim 2 is dependent on claim 1. Claim 2 further recites that the sacrificial etch portion represents a ring surrounding the wafer. Since ring (124) is not a sacrificial etch portion, it cannot disclose a sacrificial etch portion that surrounds the wafer. For these reasons, claim 2 is not anticipated by Hills et al.

Claim 7 is dependent on claim 1, and for this reason is not anticipated by Hills et al.

### **Group IV Argument**

As argued above regarding claim 1, Hills et al. does not disclose the simultaneous etching of the ring (124) and the substrate, as recited in claim 25. The Examiner failed to point out anything in Hills et al. that discloses that the ring (124) is etched. In addition, the Examiner cited col. 5, lines 60-66, of Hills et al. as stating that ring (124) is anodized aluminum. The cited passage states that the "pedestal focus ring" (114), the "gas distribution plate" (170), the "gas distribution ring" (172), and their component parts are made of anodized aluminum. Anodized aluminum has an aluminum oxygen combination surface, and therefore is not substantially pure metal, as recited in claim 25. In addition, ring 124 is not the "pedestal focus ring" (114), the "gas distribution plate" (170), the "gas distribution ring"

(172), or one of their component parts. Instead ring 124 is a supporting annulus. For these reasons, claim 25 is not anticipated by Hills et al.

Claim 31 is dependent on claim 25, and for this reason is not anticipated by Hills et al.

**35 U.S.C. §102 Rejection of Claims 1, 2, 4-10, 25, 26, 27, 28-31 and 33 under Ye et al.**

The Examiner stated that Ye et al. teach a method as claimed, citing the entire reference and especially Figs. 2, 3a, and 3b and the related description and that the method utilizes a substrate holder made from aluminum and having all the claimed limitations and that the reference recites the claimed etching process and the claimed etching gases.

**Group I Argument**

Ye et al. does not disclose that the substrate holder has a pure metallic material first surface that is parallel with the first surface of the semiconductor substrate and that is simultaneously etched, as recited in claim 1. The Examiner has not specifically cited any part of Ye et al., besides stating that the “entire reference” discloses the invention, that teaches etching of a pure metal surface that is parallel with the first surface of the semiconductor substrate and that is part of the substrate holder

Ye et al. teaches a sidewall 109 of an inlet 105 of a channel 100, column 5, lines 32 to 35, FIG. 2. Column 4, line 63, to column 5, line 2, states that “The channel 100 is dimensioned to allow a sufficient volume on non-reactive or exhausted process gas species to enter the channel to maintain a substantially uniform concentration of fresh reactive process gas across the surface of the substrate 25, thereby resulting in substantially equal processing rates of the center 80 and peripheral edge 85 of the substrate.” This passage says that only non-reactive or exhausted process gas passes into the channel and reactive process gas is kept over the surface of the substrate. It is the reactive process gas that etches the substrate. Since non-reactive or exhausted process gas is in the channel 100, the sidewall 109 is exposed to reactive or exhausted process gas. For this reason, the 109 is not simultaneously etched with the substrate, which is being etched by the reactive process gas. In addition, the quoted passage states that it is desirable to dimension the channel to provide a uniform distribution of the reactive process gas above the substrate. This would teach away from etching the sidewall 109 of the channel 100, since such etching would change the width of the channel 100. In FIG.’s 3a and 3b, the sidewall is formed by an edge 112 of a movable support structure 75. As shown in FIG. 3b during the plasma

processing, the edge 112 forms the sidewall of the inlet 105 of the channel 100. As described above, only non-reactive or exhausted process gas enters the channel, so that the edge 112 is not etched. For these reasons claim 1 is not anticipated by Ye et al.

Claim 2 is dependent on claim 1. Claim 2 further recites that the sacrificial etch portion represents a ring surrounding the wafer. Since the edge 112 is not a sacrificial etch portion, it cannot disclose a sacrificial etch portion that surrounds the wafer. For these reasons, claim 2 is not anticipated by Ye et al.

Claims 7, 8, and 10 are dependent on claim 1, and for this reason are not anticipated by Ye et al.

### **Group II Argument**

Claim 4 is dependent on claim 1 and further recites that the pure metallic material comprises pure aluminum. Although Ye et al, in column 6, lines 33 to 40, teaches that various components of the process chamber 30 and chamber itself may be made of a variety of materials including metals, ceramics, glasses, polymers, and composite materials, and preferred metals are aluminum, anodized aluminum, HAYES 242, Al-6061, SS 304, SS 316, and INCONEL, Ye et al. does not explicitly teach that the upper surface 112 of the substrate support 75 is pure aluminum. For these reasons, claim 4 is not anticipated by Ye et al.

Claims 5 and 6 are dependent on claim 4, and for this reason is not anticipated by Ye et al.

### **Group III Argument**

Claim 9 is dependent on claim 1 and further recites that the pure metallic material comprises 99.999% pure aluminum. Although Ye et al, in column 6, lines 33 to 40, teaches that various components of the process chamber 30 and chamber itself may be made of a variety of materials including metals, ceramics, glasses, polymers, and composite materials, and preferred metals are aluminum, anodized aluminum, HAYES 242, Al-6061, SS 304, SS 316, and INCONEL, Ye et al. does not explicitly teach that the upper surface 112 of the substrate support 75 is 99.999% pure aluminum. For these reasons, claim 9 is not anticipated by Ye et al.

#### **Group IV Argument**

As argued above regarding claim 1, Ye et al. does not disclose that the substrate holder has a substantially pure metallic planar upper surface that is substantially even with the first surface of the semiconductor substrate and that is simultaneously etched, as recited in claim 25. The Examiner has not specifically cited any part of Ye et al., besides stating that the “entire reference” discloses the invention, that teaches etching of a substantially pure metallic material that is substantially even with the first surface of the semiconductor substrate and that is part of the substrate holder

As stated above, regarding claim 1, Ye et al. teaches a sidewall 109 of an inlet 105 of a channel 100, column 5, lines 32 to 35, FIG. 2. Column 4, line 63, to column 5, line 2, states that “The channel 100 is dimensioned to allow a sufficient volume on non-reactive or exhausted process gas species to enter the channel to maintain a substantially uniform concentration of fresh reactive process gas across the surface of the substrate 25, thereby resulting in substantially equal processing rates of the center 80 and peripheral edge 85 of the substrate.” This passage says that only non-reactive or exhausted process gas passes into the channel and reactive process gas is kept over the surface of the substrate. It is the reactive process gas that etches the substrate. Since non-reactive or exhausted process gas is in the channel 100, the sidewall 109 is exposed to reactive or exhausted process gas. For this reason, the 109 is not simultaneously etched with the substrate, which is being etched by the reactive process gas. In addition, the quoted passage states that it is desirable to dimension the channel to provide a uniform distribution of the reactive process gas above the substrate. This would teach away from etching the sidewall 109 of the channel 100, since such etching would change the width of the channel 100. In FIG.’s 3a and 3b, the sidewall is formed by an edge 112 of a movable support structure 75. As shown in FIG. 3b during the plasma processing, the edge 112 forms the sidewall of the inlet 105 of the channel 100. As described above, only non-reactive or exhausted process gas enters the channel, so that the edge 112 is not etched. For these reasons claim 25 is not anticipated by Ye et al.

Claims 29, 31, and 33 are dependent on claim 25 and for this reason are not anticipated by Ye et al.

### **Group V Argument**

Claim 26 is dependent on claim 25 and further recites that the substantially pure metallic planar upper surface consists essentially of aluminum. Although Ye et al, in column 6, lines 33 to 40, teaches that various components of the process chamber 30 and chamber itself may be made of a variety of materials including metals, ceramics, glasses, polymers, and composite materials, and preferred metals are aluminum, anodized aluminum, HAYES 242, Al-6061, SS 304, SS 316, and INCONEL, Ye et al. does not explicitly teach that the upper surface 112 of the substrate support 75 is essentially aluminum. For these reasons, claim 26 is not anticipated by Ye et al.

Claims 27 and 28 are dependent on claim 26, and for this reason is not anticipated by Ye et al.

### **Group VI Argument**

Claim 30 is dependent on claim 25 and further recites that the substantially pure metallic planar upper surface comprises 99.999% pure aluminum. Although Ye et al, in column 6, lines 33 to 40, teaches that various components of the process chamber 30 and chamber itself may be made of a variety of materials including metals, ceramics, glasses, polymers, and composite materials, and preferred metals are aluminum, anodized aluminum, HAYES 242, Al-6061, SS 304, SS 316, and INCONEL, Ye et al. does not explicitly teach that the upper surface 112 of the substrate support 75 is 99.999% pure aluminum. For these reasons, claim 30 is not anticipated by Ye et al.

### **35 U.S.C. §103 Rejection of Claim 33 under Hills et al.**

Claim 33 is dependent on claim 25. Since Claim 25 is patentable over Hills et al., claim 33 is not made obvious by Hills et al.

### **35 U.S.C. §103 Rejection of Claims 4-6, 8-10, 26-30, and 32 under Hills et al. in view of Abraham and Abraham et al.**

The Examiner stated that Hills et al. teach improving etch uniformity of a plasma process by use of a ring (124) and that the ring has a surface, which is parallel with the surface of the substrate (110), and that the ring is made of aluminum (column 5, lines 60-66 and that the

plasma cloud extends beyond the outer periphery of the ring 124. The Examiner further stated that although Hills does not specifically claim the type of plasma apparatus, Abraham and Abraham et al teach the claimed plasma apparatus and that it would have been obvious to expend the teaching of Hills to any conventional plasma etching process.

### **Group I Argument**

Claim 8 is dependent on claim 1. For this reason, claim 8 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

Claim 10 is dependent on claim 1 and further recites that material of the sacrificial substrate holder is selected to form substantially volatile byproducts when etched by the plasma. Since Hills et al. does not disclose etching the ring (124), the formation of volatile byproducts is not disclosed. In addition, the Examiner failed to point out anything in Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring would form volatile byproducts. In addition, the Examiner failed to point out anything in Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring made of pure aluminum. For these reasons, claim 10 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

### **Group II Argument**

Claim 4 is dependent on claim 1 and further recites that the sacrificial etch portion is pure aluminum. Since ring (124), of Hills et al., is not a sacrificial etch portion, it does not disclose a pure aluminum sacrificial etch portion. In addition, the Examiner failed to point out anything in Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring made of pure aluminum. In addition, the enclosed declaration states that Hills et al. would not make obvious the sacrificial pure aluminum upper surface. The declaration goes on to state that since anodized aluminum is difficult to etch, such a surface be an unlikely sacrificial upper surface. For these reasons, claim 4 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

Claim 5 is dependent on claim 1 and further recites that the etchant source gas includes chlorine. The Examiner failed to point out anything in Hills et al. that discloses a chlorine etch. If the "pedestal focus ring" (114), the "gas distribution plate" (170), the "gas distribution ring" (172) and their components were made of pure aluminum it would not be

obvious to use the chlorine etch of Abraham or Abraham et al. with these pure aluminum components, which may cause the etching of these components. For these reasons, claim 5 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

Claim 6 is dependent on claim 5. For this reason claims 6 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

### **Group III Argument**

Claim 9 is dependent on claim 1 and further recites that the pure metallic material comprises 99.999% pure aluminum. Since ring (124), of Hills et al., is not a sacrificial etch portion, it does not disclose a 99.999% pure aluminum sacrificial etch portion. In addition, the Examiner failed to point out anything in Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring made of 99.999% pure aluminum. In addition, the enclosed declaration states that Hills et al. would not make obvious the sacrificial 99.999% pure aluminum upper surface. The declaration goes on to state that since anodized aluminum is difficult to etch, such a surface be an unlikely sacrificial upper surface. For these reasons, claim 9 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

### **Group IV Argument**

Claims 29 is dependent on claim 25. For this reason, claim 29 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

Claim 32 is dependent on claim 31. For this reason, claim 32 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

### **Group V Argument**

Claim 26, as amended, is dependent on claim 25 and further recites that the substantially pure metallic upper surface is essentially aluminum. An anodized aluminum surface is not essentially aluminum. In addition, the Examiner failed to point out anything in Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is essentially aluminum. For these reasons, claim 26 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

Claim 27 is dependent on claim 26 and further recites that the etchant source gas includes chlorine. The Examiner failed to point out anything in Hills et al. that discloses a

chlorine etch. If the "pedestal focus ring" (114), the "gas distribution plate" (170), the "gas distribution ring" (172) and their components were made essentially of aluminum it would not be obvious to use the chlorine etch of Abraham or Abraham et al. with these pure aluminum components, which may cause the etching of these components. For these reasons, claim 27 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

Claim 28 is dependent on claim 27. For this reason, claim 28 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

### **Group VI Argument**

Claim 30 is dependent on claim 25 and further recites that the substantially pure metallic planar upper surface comprises 99.999% pure aluminum. Since ring (124), of Hills et al., is not a sacrificial etch portion, it does not disclose a 99.999% pure aluminum sacrificial etch portion. In addition, the Examiner failed to point out anything in Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring made of 99.999% pure aluminum. In addition, the enclosed declaration states that Hills et al. would not make obvious the sacrificial 99.999% pure aluminum upper surface. For these reasons, claim 30 is not made obvious by Hills et al. in view of Abraham and Abraham et al.

### **35 U.S.C. §103 Rejection of Claim 32 under Ye et al.**

Claim 32 is dependent on claim 31. For this reason, claim 32 is not made obvious by Ye et al.

### **35 U.S.C. §103 Rejection of Claims 1, 2, 7, 25, 31, and 33 under Hills et al. in view of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al.**

The Examiner stated that Hills et al teach improving the etch uniformity of a plasma process by use of a ring, where the ring has a surface, which is even and parallel with the surface of the substrate, surrounds the substrate and is aluminum, col. 5, lines 60-66, and that the plasma cloud is inside and outside the ring 114 and thereby extends beyond an outer periphery of the ring and that the ring is made of an anodized aluminum. The Examiner further states that it is well-known and conventional in the art to make parts of the plasma apparatus from either aluminum or anodized aluminum citing Shamouilian et al., Kao et al., Bhan et al., Rossman et al., and Ye et al. as evidence in that the Examiner states that these references recite aluminum



and anodized aluminum as alternative materials for the internal parts of the plasma apparatus. The Examiner further stated that it would have been obvious to substitute one material for another material used for the same purpose with reasonable expectations of adequate results, so that it would have been obvious to use an aluminum ring in the method of Hill et al. with a reasonable expectation of adequate results in order to increase a selection of available materials. The Examiner further stated it would be obvious to eliminate any space between the ring and substrate where contamination can be trapped.

### **Group I Argument**

Regarding claim 1, none of the cited references teaches a metal ring that is simultaneously etched with the substrate, as recited in claim 1. Since this element is missing from all the references, claim 1 is not made obvious by the cited references.

In addition, claim 1 is for a method of improving etch uniformity, comprising placing a semiconductor substrate into a sacrificial substrate holder of a pure metallic material first surface, which is parallel to the surface of the substrate, placing the semiconductor substrate holder into a plasma chamber, striking a plasma, and simultaneously etching the substrate and a surface of the sacrificial etch portion, as recited in claim 1, is not made obvious by a combination of the cited references. The cited references do not make obvious this combination of steps.

*In re Vaeck* (20 USPQ2nd 1438) states that “Where claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under § 103 requires, inter alia, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have reasonable expectation of success.” The Examiner has not pointed out in any of the references that suggests that providing a sacrificial etch surface parallel to the substrate surface and simultaneously etching the sacrificial etch surface and the substrate surface would successfully provide a more uniform etch, and therefore has not met the requirements of *In re Vaeck*.

In addition, *Ex parte Clapp* (227 USPQ 972) states that “To support the conclusion that the claimed combination is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed combination or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to

have been obvious in light of the teachings of the reference” The Examiner has failed to point out parts of the cited references that expressly or impliedly suggest the claimed combination and does not seem to provide a convincing line of reasoning why this would be obvious to in view of the cited references, as required by *Ex parte Clapp*.

For these reasons, claim 1 is not made obvious under Hills et al. in view of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al.

Claims 2 and 7 are dependent on claim 1 and for this reason are not made obvious under Hills et al. in view of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al.

#### **Group IV Argument**

Regarding claim 25, as discussed above regarding claim 1, none of the cited references teaches a metal ring that is simultaneously etched with the substrate, as recited in claim 25. Since this element is missing from all the references, claim 25 is not made obvious by the cited references.

In addition, claim 25 is for a method of improving etch uniformity comprising, providing an annular sacrificial substrate holder having a substantially pure metallic upper surface, placing a semiconductor substrate into the sacrificial substrate holder so that the upper surface is substantially even with the planar upper surface, and creating a plasma, which simultaneously etches the substrate and a surface of the sacrificial etch portion, as recited in claim 25, is not made obvious by a combination of the cited references. The cited references do not make obvious this combination of steps.

With regards to *In re Vaeck* discussed above, the Examiner has not pointed out in any of the references that suggests that providing a sacrificial etch surface that is substantially even with the substrate surface and simultaneously etching the sacrificial etch surface and the substrate surface would successfully provide a more uniform etch, and therefore has not met the requirements of *In re Vaeck*.

With regards to *Ex parte Clapp* (227 USPQ 972) discussed above, the Examiner has failed to point out parts of the cited references that expressly or impliedly suggest the claimed combination and does not seem to provide a convincing line of reasoning why this would be obvious to in view of the cited references, as required by *Ex parte Clapp*.

For these reasons, claim 25 is not made obvious under Hills et al. in view of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al.

Claims 31 and 33 are dependent on claim 25 and for this reasons are not made obvious under Hills et al. in view of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al.

**35 U.S.C. §103 Rejection of Claims 4-6, 8-10, 26-30, and 32 under Hills et al. in view of any one of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and further in view of Abraham and Abraham et al.**

The Examiner stated that Hills do not recite the specifically claimed type of plasma apparatus but also do not limit their method to the use of any specific type of apparatus and that Abraham and Abraham et al. teach the claimed chambers and process and that it would have been obvious to expend the modified teaching of Hills to any conventional plasma etching process.

**Group I Argument**

Claim 8 is dependent on claim 1. For this reason, claim 8 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

Claim 10 is dependent on claim 1 and further recites that material of the sacrificial substrate holder is selected to form substantially volatile byproducts when etched by the plasma. Since Hills et al. does not disclose etching the ring (124), the formation of volatile byproducts is not disclosed. In addition, the Examiner failed to point out anything in Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring would form volatile byproducts. For these reasons, claim 10 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

**Group II Argument**

Claim 4 is dependent on claim 1 and further recites that the sacrificial etch portion is pure aluminum. Since ring (124), of Hills et al., is not a sacrificial etch portion, it does not

disclose a pure aluminum sacrificial etch portion. In addition, the Examiner failed to point out anything in Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, Ye et al., Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring made of pure aluminum. In addition, the enclosed declaration states that Hills et al. would not make obvious the sacrificial pure aluminum upper surface. The declaration goes on to state that since anodized aluminum is difficult to etch, such a surface be an unlikely sacrificial upper surface. For these reasons, claim 4 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

Claims 5 and 6 are ultimately dependent on claim 1. For this reason claims 6 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

### **Group III Argument**

Claim 9 is dependent on claim 1 and further recites that the pure metallic material comprises 99.999% pure aluminum. Since ring (124), of Hills et al., is not a sacrificial etch portion, it does not disclose a 99.999% pure aluminum sacrificial etch portion. In addition, the Examiner failed to point out anything in Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, Ye et al., Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring made of 99.999% pure aluminum. In addition, the enclosed declaration states that Hills et al. would not make obvious the sacrificial 99.999% pure aluminum upper surface. The declaration goes on to state that since anodized aluminum is difficult to etch, such a surface be an unlikely sacrificial upper surface. For these reasons, claim 9 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

### **Group IV Argument**

Claims 29 is dependent on claim 25. For this reason, claim 29 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

Claim 32 is dependent on claim 31. For this reason, claim 32 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

#### **Group V Argument**

Claim 26, as amended, is dependent on claim 25 and further recites that the substantially pure metallic upper surface is essentially aluminum. An anodized aluminum surface is not essentially aluminum. In addition, the Examiner failed to point out anything in Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, Ye et al., Abraham, or Abraham et al.. that teaches having the recited ring and that the recited ring is essentially aluminum. For these reasons, claim 26 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

Claim 27 is dependent on claim 26 and further recites that the etchant source gas includes chlorine. For this reason, claim 27 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

Claim 28 is dependent on claim 27. For this reason, claim 28 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

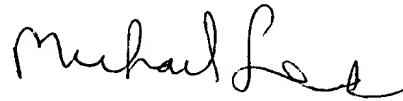
#### **Group VI Argument**

Claim 30, is dependent on claim 25 and further recites that the substantially pure metallic planar upper surface comprises 99.999% pure aluminum. Since ring (124), of Hills et al., is not a sacrificial etch portion, it does not disclose a 99.999% pure aluminum sacrificial etch portion. In addition, the Examiner failed to point out anything in Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, Ye et al., Abraham or Abraham et al. that teaches having the recited ring and that the recited ring is a sacrificial ring made of 99.999% pure aluminum. In addition, the enclosed declaration states that Hills et al. would not make obvious the sacrificial 99.999% pure aluminum upper surface. For these reasons, claim 30 is not made obvious by Hills et al. in view of any of Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, and Ye et al. and in further view of Abraham and Abraham et al.

### **Conclusion**

Regarding all the rejections, the cited references fail to teach or suggest elements required in the pending claims. This is true regardless of whether these references are considered alone or combination with one another. In view of the foregoing, it is respectfully submitted that none of the pending claims are rendered unpatentable by the patents to Hills et al., Shamouilian et al, Kao et al. Zao et al., Bhan et al., Rossman et al, Ye et al., Abraham, and Abraham et al.. Accordingly, the pending rejections of all of the claims under 35 U.S.C. § 102 and 35 U.S.C. § 103 should be reversed.

Respectfully submitted,  
BEYER WEAVER & THOMAS

A handwritten signature in black ink, appearing to read "Michael Lee", with a stylized flourish at the end.

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**(9) APPENDIX**

1. (Thrice Amended) In a plasma processing chamber, a method for improving etch uniformity while etching a semiconductor substrate, comprising:

placing said semiconductor substrate into a sacrificial substrate holder, said sacrificial substrate holder being configured to present a sacrificial etch portion surrounding said semiconductor substrate to a plasma within said plasma processing chamber to permit said plasma to etch a first surface of said semiconductor substrate and a first surface of said sacrificial etch portion simultaneously, said first surface of said sacrificial etch portion being formed of a pure metallic material capable of being etched by said plasma and configured to be parallel with said first surface of said semiconductor substrate;

positioning said semiconductor substrate and said sacrificial substrate holder into said plasma processing chamber;

striking said plasma from an etchant source gas released into said plasma processing chamber; and

simultaneously etching said first surface of said semiconductor substrate and said first surface of said sacrificial etch portion using said plasma.

2. The method of claim 1 wherein said semiconductor substrate represents a wafer and wherein said sacrificial etch portion represents a ring surrounding said wafer.

4. (Twice Amended) The method of claim 1 wherein said etching is a metallization etch, said pure metallic material comprising pure aluminum.

5. The method of claim 4 wherein said etchant source gas includes chlorine.

6. The method of claim 5 wherein said plasma processing chamber represents an inductively coupled plasma processing chamber.

7. The method of claim 1 wherein said semiconductor substrate represents a substrate for fabricating integrated circuits (IC's).

8. The method of claim 1 wherein said plasma processing chamber represents an inductively coupled plasma processing chamber.

9. (Once Amended) The method of claim 1 wherein said etching is a metallization etch and said pure metallic material comprises 99.999% pure aluminum.

10. The method of claim 1 wherein said material is selected to form substantially volatile byproducts when etched by said plasma within said plasma processing chamber.

25. In a plasma processing chamber, a method for improving etch uniformity while etching a semiconductor substrate, comprising:

providing an annular sacrificial substrate holder having a substantially pure metallic planar upper surface;

placing a semiconductor substrate within said sacrificial substrate holder such that an upper surface of said semiconductor substrate is substantially even with said planar upper surface of said annular sacrificial substrate holder; and

creating a plasma etching cloud from an etchant source gas released into said plasma processing chamber to simultaneously etch said upper surface of said semiconductor substrate and upper planar surface of said sacrificial etch portion, wherein



said sacrificial substrate holder is dimensioned such that said plasma etching cloud extends beyond an outer periphery of said sacrificial substrate holder during said etching.

26. The method of claim 25 wherein said etching is an aluminum etch and wherein the substantially pure metallic planar upper surface consists essentially of aluminum.

27. The method of claim 26 wherein said etchant source gas includes chlorine.

28. The method of claim 27 wherein said plasma processing chamber represents an inductively coupled plasma processing chamber.

29. The method of claim 25 wherein said plasma processing chamber represents an inductively coupled plasma processing chamber.

30. (Once Amended) The method of claim 25 wherein said etch is a metallization etch and said substantially pure metallic planar upper surface comprises 99.999% pure aluminum.

31. The method of claim 25 wherein a lower surface of said semiconductor substrate is in direct contact with a chuck of said plasma processing chamber.

32. The method of claim 31 wherein said chuck represents a chuck employing helium cooling.

33. The method of claim 25 wherein an inner periphery of said annular sacrificial substrate holder is dimensioned to contact said semiconductor substrate.